

## CLAIMS

1. A device for regulating the flow which can be applied to a main valve operating under differential pressure wherein said main valve (1, 2, 4, 7, 9) has a main flow  
5 inlet (112, 212, 412, 712, 912) and a main flow outlet (113, 213, 413, 713, 913) wherein said main flow inlet is equipped with a valve seat (114, 214, 414, 714, 914) over which a main shutter (100, 200, 400, 700, 900) is adjusted likely to shift in a perpendicular direction to its shuttering plane, wherein said main shutter has a hole (111, 211, 411, 711, 911) on its locking face, with said device comprising as  
10 follows:
  - a) A pressure chamber (110, 210, 410, 710, 910) of a variable volume which is located over said main shutter with the volume of such pressure chamber being confined between said main shutter up to an upper area (160, 260, 460, 760, 960) which is substantially rigid; said pressure chamber communicates  
15 with the main flow inlet through said hole (111, 211, 411, 711, 911);
  - b) A hollow axial stem (104, 204, 404, 704, 904) opened in its two ends and which bottom is joined to the center of said main shutter, so that a permanent communication of the main flow is admitted from said main flow inlet going through said hole (111, 211, 411, 711, 911);
  - 20 c) Said upper area (160, 260, 460, 760, 960) has a hole in its center, through which said hollow axial stem goes through, wherein said upper area hole is equipped with sealing means allowing the displacement of said axial stem;

- d) One or more openings for the discharge of control flow (121, 221, 421, 721, 921) located over said sealing means;
  - e) An opening (108, 208, 408, 708, 908) in said hollow axial stem communicating with said pressure chamber wherein said opening is located  
5 below the plane defined by the bottom of said upper area (160, 260, 460, 760, 960);
  - f) A secondary control valve seat (106, 206, 406, 706, 906) defined in the open upper end of said axial hollows stem; and
  - g) Locking means of said secondary control valve seat, with the area of said  
10 hole (111, 211, 411, 711, 911) of said main shutter being smaller than the area of said opening of the secondary control valve seat (106, 206, 406, 706, 906).
2. A device for regulating the flow as in claim 1, wherein said locking means of said secondary control valve seat consist of:
- 15 - an axial commanding stem (103, 403, 703, 903) axially aligned over said secondary control valve seat; and
  - a shutter of the secondary control valve (105, 405, 705, 905) located in the lower end of said axial commanding stem.
3. A device for regulating the flow as in claim 2, wherein said axial commanding stem  
20 (703) is joined to said hollows stem (704) by limiting means (724) which are integral part of the upper portion of said hollow stem and which keep said axial commanding stem in a sliding way within a preset axial range, wherein said axial commanding stem may be displaced in a range without dragging said hollow stem

by mechanical contact and, beyond said range, the axial commanding stem drags the hollow stem through said limiting means.

4. A device for regulating the flow as in claim 2, wherein said hole for the discharge of control flow (421, 721, 921) communicates through a pipe (469, 769, 969) downstream said main outlet (413, 713, 913), wherein said axial commanding stem (403, 703, 903) is kept in an extreme position of opened valve by a spring (450, 750, 950).

5. A device for regulating the flow as in claim 2, wherein said main shutter (900) is associated with a lifting spring (925), wherein said lifting spring has a first lower support fixed to the internal wall of said upper area (960) of said pressure chamber (910), wherein said lifting spring has a second support in a moving ratio and joint to the central upper portion of said main shutter (900).

6. A device for regulating the flow as in claim 4 wherein said axial commanding stem (703) is joined to said hollows stem (704) by limiting means (724) which are integral part of the upper portion of said hollow stem and which keep said axial commanding stem in a sliding way within a preset axial range, wherein said axial commanding stem may be displaced in a range without dragging said hollow stem by mechanical contact and, beyond said range, the axial commanding stem drags the hollow stem through said limiting means.

7. A device for regulating the flow as in claim 1, wherein said locking means of said secondary control valve seat consists of:

- a stem of lever of angular movement (203) with a driving end and a zone of the shutter (205) placed in a ratio which is likely to lock said secondary control valve.

8. A device for regulating the flow which can be applied to a main valve operating under differential pressure wherein said main valve (3) has a main flow inlet (312) and a main flow outlet (313) wherein said main flow inlet is equipped with a valve seat (314) over which a main shutter (300) is adjusted likely to shift in a perpendicular direction to its shuttering plane, wherein said main shutter has a hole (321) on its locking face, with said device comprising as follows:

- 10 a) A pressure chamber (310) of a variable volume which is located over said main shutter with the volume of such pressure chamber being confined between said main shutter up to an upper area (360) which is substantially rigid; said pressure chamber communicates with the main flow inlet through said hole (311);
- 15 b) A hollow axial stem (304) opened in its two ends and which bottom is joined to the center of said main shutter over said discharge opening, so that a permanent communication of the main flow is admitted from said pressure chamber going through said hole of the upper end;
- 20 c) Said upper area (360) has a hole in its center, through which said hollow axial stem (303) goes through, which is axially aligned over said hollows axial stem (304) and its free end projecting outside said pressure chamber, going through said opening of the upper area (360), wherein said opening of

the upper area is equipped with sealing means allowing the displacement of said axial stem;

d) A secondary control valve seat (306) defined in the open upper end of said axial hollows stem;

5 e) A shutter of said secondary control valve seat (305) located in the lower end of said axial commanding stem; and

f) Braking means (330) associated with the perimetric surface of the free end of said axial stem

wherein the area of said hole (311) communicating with said pressure chamber is

10 smaller than the area of said opening in the secondary control valve seat (306)

9. A device for regulating the flow which can be applied to a main valve operating under differential pressure wherein said main valve (5, 7) has a main flow inlet (512, 712) and a main flow outlet (513, 713) wherein said main flow inlet is equipped with a valve seat (514, 714) over which a main shutter (500, 700) is  
15 adjusted likely to shift in a perpendicular direction to its shuttering plane, with said device comprising as follows:

a) A pressure chamber (510, 710) of a variable volume which is located over said main shutter with the volume of such pressure chamber being confined between said main shutter up to an upper area (560, 760) which is  
20 substantially rigid; said pressure chamber communicates with the main flow inlet through a pipe (568, 768);

b) A hollow axial stem (504, 704) opened in its two ends and which bottom is joined to the center of said main shutter, so that a permanent communication

of the main flow is admitted from said main flow inlet going through said pipe (568, 768);

c) Said upper area (560, 760) has a hole in its center, through which said hollow axial stem goes through, wherein said upper area hole is equipped with sealing means allowing the displacement of said axial stem;

d) One or more openings for the discharge of control flow (521, 721) located over said sealing means, wherein said openings for the discharge of control flow are communicated through a pipe (569, 769) downstream said main outlet (513, 713);

e) An opening (508, 708) in said hollow axial stem communicating with said pressure chamber wherein said opening is located below the plane defined by the bottom of said upper area (560, 760);

f) A secondary control valve seat (506, 706) defined in the open upper end of said axial hollow stem; and

g) Locking means of said secondary control valve seat, consisting of:

- an axial commanding stem (503, 703) axially aligned over said secondary control valve seat;
- a shutter of the secondary control valve (505, 705) located in the bottom end of said axial commanding stem; and

h) Spring means (550, 750) allowing keeping said axial commanding stem (503, 703) in an extreme position of closed valve,

with the area of said pipe (568, 768) or the area of a pass thereof being smaller than the area of said hole of the secondary control valve seat (506, 706).

10. A device for regulating the flow as in claim 9 wherein said axial commanding stem (703) is joined to said hollow stem (704) by limiting means (724) which are integral part of the upper portion of said hollow stem and which keep said axial commanding stem in a sliding way within a preset axial range, wherein said axial commanding stem may be displaced in a range without dragging said hollow stem by mechanical contact and, beyond said range, the axial commanding stem drags the hollow stem through said limiting means.
11. A device for regulating the flow which can be applied to a main valve operating under differential pressure wherein said main valve (6, 8) has a main flow inlet (612, 812) and a main flow outlet (613, 813) wherein said main flow inlet is equipped with a valve seat (614, 814) over which a main shutter (600, 800) is adjusted likely to shift in a perpendicular direction to its shuttering plane; said main shutter has a hole (611, 811) on its locking face, with said device comprising as follows:
  - a) A pressure chamber (610, 810) of a variable volume which is located over said main shutter with the volume of such pressure chamber being confined between said main shutter up to an upper area (660, 860) which is substantially rigid; said pressure chamber communicates with the main flow inlet through said hole (611, 811);
  - b) A tubular axial stem (622, 822) opened in its two ends and which bottom is joined to the center of said main shutter, so that a permanent communication of the main flow is admitted from said main flow inlet going through said hole (611, 811);

- c) Said upper area (660, 860) has a hole in its center, through which said tubular axial stem goes through, wherein said upper area hole is equipped with sealing means allowing the displacement of said axial tubular stem;
- d) One or more openings for the discharge of control flow (621, 821) located  
5 over said sealing means;
- e) An opening (608, 808) in said tubular axial stem communicating with said pressure chamber wherein said opening is located below the plane defined by the bottom of said upper area (660, 860);
- f) A secondary control valve seat (606, 806) defined inside said axial tubular  
10 stem and located in an area between said opening (608, 808) and said opening for the discharge of control flow (621, 821);
- g) An axial commanding stem (603, 803) which is substantially concentric with said axial tubular stem and arranged in such a way that a portion of said lower end of said axial commanding stem is inside said tubular axial stem,  
15 wherein a portion of the upper end of said axial, commanding stem is outside the portion of said axial tubular stem, with such axial commanding stem being supported inside said tubular axial stem in a sliding and sealing ratio through sealing means;
- h) A shutter of the secondary control valve (605, 805) located in the bottom end  
20 of said axial commanding stem; and
- h) A spring (650, 850) mechanically linked between said axial commanding stem and said tubular axial stem, thus allowing said axial commanding stem



being kept in an extreme position when no external forces are exerted on  
said spring,

with the area of said hole (611, 811) of said main shutter being smaller than the area  
of said hole of the secondary control valve seat (606, 806).

- 5 12. A device for regulating the flow as in claim 11, wherein said extreme position of  
said axial commanding stem is an automatically closed position.
13. A device for regulating the flow as in claim 12 wherein said axial commanding stem  
(803) is joined to said tubular stem (822) by limiting means (824) which are integral  
part of the inside portion of said tubular stem and which keep said axial  
10 commanding stem in a sliding way within a preset axial range according to design,  
wherein said axial commanding stem may be displaced in a range without dragging  
said tubular stem by mechanical contact and, beyond said range, the axial  
commanding stem drags the hollow stem through said limiting means.
14. A device for regulating the flow as in claim 11, wherein said extreme position of  
15 said axial commanding stem is an automatically opened position.
15. A device for regulating the flow as in claim 14 wherein said axial commanding stem  
(803) is joined to said tubular stem (822) by limiting means (824) which are integral  
part of the inside portion of said tubular stem and which keep said axial  
commanding stem in a sliding way within a preset axial range according to design,  
20 wherein said axial commanding stem may be displaced in a range without dragging  
said tubular stem by mechanical contact and, beyond said range, the axial  
commanding stem drags the hollow stem through said limiting means.

16. A device for regulating the flow which can be applied to a main valve operating under differential pressure wherein said main valve (10, 11) has a main flow inlet (1012, 1112) and a main flow outlet (1013, 1113) wherein said main flow inlet is equipped with a valve seat (1014, 1114) over which a main shutter (1000, 1100) is adjusted likely to shift in a perpendicular direction to its shuttering plane, wherein said main shutter has a hole (1011, 1111) on its locking face, with said device comprising as follows:

a) A pressure chamber (1010, 1110) of a variable volume which is located over said main shutter with the volume of such pressure chamber being confined between said main shutter up to an upper area (1060, 1160) which is substantially rigid; said pressure chamber communicates with the main flow inlet through said hole (1011, 1111);

b) Said upper area (1060, 1160) has an opening connected to an end of the pipe (1068, 1168) while the other end of said pipe discharges downstream; and

c) A secondary control valve seat (1002, 1102) locked in said pipe.

17. A device for regulating the flow as in claim 16, which also comprises a follows:

a) An axial commanding stem (11039 fixed to the central area of the upper face of said main shutter;

b) Said upper area (1160) has an opening in its center, through which said axial stem goes through, with said opening of the upper area being equipped with sealing means allowing the displacement of said axial stem;

- c) An opening (1108) in said axial stem communicating said hole (1111) to said pressure chamber, with said opening being located below the plane defined by the bottom of said upper area (1160).